

SWIARC

Ship-based wind lidar measurements of the Arctic boundary layer



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Areas of contribution

User-aspects and verification

Polar atmospheric processes

Observations

Summary

The group of the University of Trier, Germany, will perform measurements of vertical and horizontal profiles of wind, turbulence and aerosols. We will use a wind lidar, which is a programmable scanner and can operate with a maximum range of 10 km. The wind lidar is operated in the Arctic during two cruises of R/V Polarstern: PS106 around Svalbard (24 May–24 July 2017) and PS109 in the Fram Strait and at the east Greenland coast (12 September–14 October 2017). Radiosondes launched from Polarstern will be used for comparisons of the wind profiles. The data will be used for the verification of simulations using a high-resolution regional climate model and for process studies.

Description

The representation of the atmospheric boundary layer (ABL) in the Arctic is a major challenge for numerical weather forecast models and regional climate models. Reference data sets are rare, particularly over the ocean areas. Standard measurements on research vessels yield near-surface observations and one or two radiosonde

launches per day.

We use a scanning wind lidar, which measures wind profiles in the ABL with a high vertical resolution (15 m) and a high temporal resolution (15 min). The wind lidar can operate with a maximum range of 10 km. The used lidar is a programmable scanner, which enables vertical scans in all directions. The main scan patterns are the vertical azimuth display (VAD), the range-height indicator (RHI) and horizontal scans with fixed azimuth (STARE). The VAD is used for the determination of wind profiles above the lidar. The STARE mode is used at two or three azimuth angles, which are adjusted to the heading of the ship and the wind direction. The RHI mode is generally applied together with the STARE mode and at the same azimuth angles to obtain cross-sections. This allows for measurements of e.g. the internal boundary layer at the sea ice edge or ice shelf front. Since the lidar is not mounted on a stabilized platform, the ship's heading, roll and pitch angles are recorded using an Attitude Heading Reference System (AHRS), an external GPS and data from the ship's navigation system.

The measurements during the Polarstern cruises shall yield a data set of continuous and high-resolution vertical profiles of wind and aerosol backscatter. Continuous sampling of vertical profiles is performed during the cruises. For intensive observation periods during the cruises, RHI and horizontal scans will be performed additionally yielding cross-sections of the ABL. The data will be used for the verification of simulations using a high-resolution regional climate model and for process studies.

Timeline

2017-05-01 - 2017-10-31

Regional emphasis

Northern hemisphere: Yes

Southern hemisphere: No

Further specification

Svalbard and Greenland

Key project deliverables

Wind profiles in the atmospheric boundary layer with high spatial (15 m) and temporal resolution (15 min).

Data management

All lidar data will be stored at data servers of the University of Trier. After a thorough quality control, processing and publication in a peer reviewed journal, the processed data will be stored in the PANGAEA data base.

Is data provided to WMO Global Telecommunication System

No

Real-time provision

no.